About Dictyostelium

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Dictyostelium discoideum is a powerful system for basic biomedical research in cell and developmental biology. The organism has unique advantages for studying fundamental cellular processes with powerful molecular genetic tools. These processes include cytokinesis, motility, phagocytosis, chemotaxis, signal transduction, and aspects of development such as cell sorting, pattern formation, and cell-type determination. Many of these cellular behaviors and biochemical mechanisms are either absent or less accessible in other model organisms. For this reason, the NIH has chosen D. discoideum along with several other model organisms for functional analysis of sequenced genes. This presentation outlines the unique advantages of this model system, lists some of the important findings that have been derived from its study, and describes the community's goals for developing infrastructure to facilitate the use of Dictyostelium.

Many phases of health and disease depend on the behaviors of individual cells so beautifully displayed in *D. discoideum*. For example, cytokinesis is critical in cell proliferation and is therefore an integral part of immune response, tissue maintenance, and cancer. Cell motility is an essential early event in metastasis of tumor cells and in angiogenesis by endothelial cells. Chemotaxis and signal transduction by chemoattractant receptors play a key role in inflammation, arthritis, asthma, lymphocyte trafficking, and also in axon guidance. Phagocytosis is a critical process involved in immune surveillance and antigen presentation. Cell-type determination, cell sorting, and pattern formation are basic features of embryogenesis and alteration of these events can lead to neoplasms. Recent studies have taken advantage of the organism's genetics to study myosin mutations that cause cardiac myopathies, resistance to the anti-metabolite cis-platin, and the mechanism of action of lithium. In addition, infectious diseases such as Malaria, Legionnaire's disease, Salmonellosis, Tuberculosis, Lysteriosis, amoebic dysentery, and Pseudomoniasis are

caused directly by amebae or involve ameboid hosts.

Dictyostelium amoebae grow as separate, independent cells but interact to form multicellular structures when challenged by adverse conditions such as starvation. Up to 100,000 cells signal each other by releasing the chemoattractant cAMP and aggregate together by chemotaxis to form a mound that is surrounded by an extracellular matrix. This mechanism for generating a multicellular organism differs radically from the early steps of metazoan embryogenesis. However, subsequent processes depend on cell-cell communication in both Dictyostelium and metazoans. Many of the underlying molecular and cellular processes appear to have arisen in primitive precursor cells and to have remained fundamentally unchanged throughout evolution. Basic processes of development such as differential cell sorting, pattern formation, stimulus-induced gene expression, and cell-type regulation are common to Dictyostelium and metazoans.

The following sections of this presentation provide a collection of examples of research being carried out using *D. discoideum*. Many of the examples are presented in video format in order to fully demonstrate the dynamic behavior of these cells.

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